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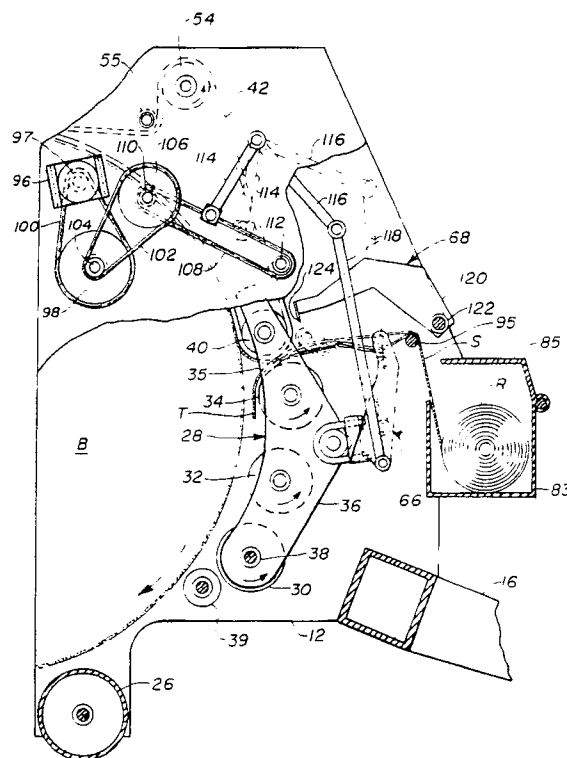
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54 **Bale wrapping apparatus for round balers.**

57 Apparatus for wrapping cylindrical bales (B) of crop material formed in a bale forming chamber of an agricultural baler (10) with sheet material (S) such as net or plastic film. The apparatus includes a dispensing mechanism (66) which is movable from a retracted position to a dispensing position for inserting a tail (T) of the sheet material (S) into the bale forming chamber of the baler (10) so that the sheet material (S) is wrapped circumferentially around a cylindrical bale (B) disposed therein. The dispensing mechanism (66) comprises a pair of clamping members (80, 126 resp. 82, 128) that grip the tail (T) of the sheet material (S) and between which the sheet material (S) is dispensed during bale wrapping. The apparatus also includes a motor (96) and a plurality of links (114, 116, 118) for moving the dispensing mechanism (66) between its retracted and dispensing positions.

Fig. 2



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BALE WRAPPING APPARATUS FOR ROUND BALERS

This invention relates generally to agricultural balers typically referred to as round balers which form cylindrical (i.e. round) bales of crop material and, in particular, to bale wrapping apparatus for use on such round balers and to a method of wrapping such bales.

It is known in a conventional type of round baler to provide an arrangement for wrapping bales with sheet material such as net or plastic film for example. Typically, such wrapping arrangements comprise feed rollers arranged to dispense the sheet material into the baler. Examples of prior art balers employing feed rollers as sheet material dispensing means are disclosed a.o. in US-A-4.729.213 and US-A-4.790.125. One of the drawbacks of these prior art bale wrapping apparatus is that the sheet material tends to wrap around and get tangled up on the feed rollers. High machining costs are also inherent to feed rollers, resulting in such rollers being highly expensive.

Feed rollers furthermore are not always suited on every type of round baler, as the kind of means employed to form a round bale may be incompatible with the way of operation of feed rollers. For example, in US-A-4.807.812, a round baler is disclosed wherein a sledge assembly comprising a plurality of rollers cooperates with an apron consisting of a plurality of belts to define a bale forming chamber therebetween. The sledge assembly, which is movable between a bale starting position and a full bale position during bale formation, further comprises an idler roller in engagement with the apron to maintain the apron in close proximity to one of said rollers during movement of the sledge assembly between said bale starting and full bale positions. As the inlet or throat for the sheet material into the bale forming chamber is defined by the space between the idler roller and the adjacent roller on the sledge assembly, resulting in said inlet being rather confined, it is found difficult to employ conventional wrapping apparatus having feed rollers. Furthermore, there is not enough space available on the baler disclosed in US-A-4.870.812 for mounting said conventional wrapping apparatus.

It is therefore the objective of the present invention to provide bale wrapping apparatus as well as a method for dispensing sheet material and wrapping cylindrical bales of crop material therewith without utilizing feed rollers.

According to one aspect of the present invention, an agricultural baler is provided comprising :

- a bale forming chamber in which cylindrical bales of crop material are formed; and
- a bale wrapping apparatus including means

for dispensing sheet material from a supply source into the bale forming chamber of the baler in a manner such that it is wrapped circumferentially around a cylindrical bale of crop material disposed in the bale forming chamber; and which is

characterized in that said dispensing means :

- are movable between a retracted position wherein sheet material is prevented from being dispensed into the bale forming chamber and a dispensing position wherein sheet material is dispensed from the supply source into the bale forming chamber; and

- include means for gripping a tail of the sheet material when the dispensing means is in said retracted position and for inserting said tail into the bale forming chamber when the dispensing means is in said dispensing position.

Preferably, said gripping means comprise a pair of juxtaposed clamping members including an upper plate and a lower plate which are resiliently urged towards each other. An electric motor and link means are provided for moving the sheet dispensing means between said retracted and dispensing positions.

The bale wrapping apparatus according to the instant invention is suitably mounted on a round baler comprising a sledge assembly having a plurality of rollers extending transversely of the baler frame. An apron is movably supported on said frame and cooperates with said rollers to define the bale forming chamber. The sheet dispensing means are pivotally mounted on the sledge assembly and are operable to insert the tail of the sheet material into the bale forming chamber through a gap between the apron and one of the rollers of the sledge assembly.

According to another aspect of the present invention, a method of wrapping cylindrical bales of crop material with sheet material in a bale forming chamber of an agricultural baler is provided; said method comprising the step of gripping a tail of the sheet material in dispensing means during formation of a cylindrical bale of crop material; and

being characterized in that it further also comprises the steps of :

- moving the dispensing means from a retracted position to a dispensing position after completion of a cylindrical bale in the bale forming chamber;

- inserting said tail of the sheet material into the bale forming chamber when the dispensing means is in said dispensing position; and

- moving the dispensing means from the dispensing position to the retracted position after at least one layer of sheet material has been wrapped

circumferentially around said cylindrical bale.

The inserting step referred to hereabove is performed without utilizing feed rollers.

A bale wrapping apparatus and a method for wrapping cylindrical bales with sheet material in accordance with the present invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a side elevational view of a round baler according to the preferred embodiment of the present invention;

Figure 2 is an enlarged side elevational view of a portion of the round baler of Figure 1 illustrating the bale wrapping method of the present invention;

Figure 3 is an enlarged view of part of the round baler of Figure 1;

Figure 4 is a view taken in the direction of arrows 4-4 in Figure 3;

Figure 5 is a view taken in the direction of arrows 5-5 in Figure 3; and

Figure 6 is a view taken in the direction of arrows 6-6 in Figure 3.

Referring to Figure 1, a round baler 10 according to the present invention includes a main frame 12 supported by a pair of wheels 14. A tongue 16 is provided on the forward portion of the main frame 12 for connection to a tractor (not shown). A tailgate 18 is pivotally connected to the main frame 12 by stub shafts 20 so that the tailgate 18 may be closed as shown in Figure 1 during bale formation or opened to discharge a completed bale. A conventional pickup 22 is mounted on the main frame 12 and is supported by a pair of wheels (not shown). The pickup 22 includes a plurality of fingers or tines 24 movable in a predetermined path to lift crop material from the ground and deliver it rearwardly toward a floor roll 26 which is rotatably mounted on the main frame 12.

A sledge assembly 28 includes a plurality of rollers 30, 32, 34 extending transversely of the main frame 12 in an arcuate arrangement best seen in Figure 2. The rollers 30, 32, 34 are journaled at the ends thereof in a pair of spaced apart arms 36. These arms 36 are pivotally mounted inside the main frame 12 on stub shafts 38 for permitting movement of the sledge assembly 28 between a bale starting position shown in broken lines in Figure 1 and a full bale position shown in solid lines in Figure 1. The rollers 30, 32, 34 are driven in a counterclockwise direction as viewed in Figures 1 and 2 by conventional means (for example, chains and sprockets or gears) connected with a drive shaft 17 which is adapted for connection to the power take off of a tractor (not shown). A stripper roll 39 is located adjacent roller 30 and is driven in a counter clockwise direction, as viewed in Figure 2, to strip crop material from the roller 30.

An idler roller 40 is carried by the arms 36 for movement in an arcuate path when the sledge assembly 29 moves between its bale starting and full bale positions. The idler roller 40 is freely rotatable.

An apron 42 includes a plurality of flat belts arranged side-by-side and supported on guide rolls 44, 46, 48, 50, 52 which are rotatably mounted in the tailgate 18. The apron 42 is also supported on a drive roll 54 which is rotatably mounted in the main frame 12. Although the apron 42 passes between the roller 34 and the idler roller 40, it is in engagement with only the idler roller 40 but the roller 34 is located in close proximity to the apron belts to strip crop material from the apron 42. Further conventional means (not shown) are connected with the drive shaft 17 to provide rotation of the drive roll 54 in a direction which causes movement of the apron 42 along the path indicated in broken lines in Figure 1. An additional guide roll 55 in the main frame 12 ensures proper driving engagement between the apron 42 and the drive roll 54. A pair of take up arms 56 are pivotally mounted on the main frame 12 by a cross shaft 58 for movement between inner and outer positions shown in Figure 1. Take up arms 56 carry additional guide rolls 60 and 62 for supporting the apron 42. Resilient means (not shown) are provided to normally urge the take up arms 56 toward their inner positions while resisting movement thereof from their inner positions to their outer positions.

When the round baler 10 is in the condition shown in Figure 1 with the tailgate 18 closed, an inner course 42a of the apron 42 extending between the guide roll 44 and the idler roller 40 cooperates with the rollers 30, 32, 34 of the sledge assembly 28 to define a bale forming chamber. The apron inner course 42a forms a rear wall of the chamber while the rollers 30, 32, 34 form a front wall of the chamber. The floor roll 26 is disposed in the bottom of the chamber between the front and rear walls thereof, and the roller 30 is spaced from the floor roll 26 to form a throat or inlet for the chamber.

As the round baler 10 is towed across a field by a tractor (not shown), the pickup tines 24 lift crop material from the ground and deliver it through the throat formed between the floor roll 26 and the roller 30 into the bale forming chamber of the baler 10. The crop material is carried rearwardly by the floor roll 26 into engagement with the apron inner course 42a which carries it upwardly and forwardly into engagement with the rollers 30, 32, 34. The crop material is coiled in a clockwise direction as viewed in Figure 1 to start a bale core. Continued feeding of crop material into the bale forming chamber by the pickup tines 24 causes the apron inner course 42a to expand in length around

a portion of the circumference of the bale core as the diameter thereof increases. The take up arms 56 rotate from their inner position shown in Figure 1 toward their outer position to permit such expansion of the apron inner course 42a. When a bale has been formed and then wrapped as described later with sheet material such as net or plastic film, the tailgate 18 is opened by conventional means (for example, hydraulic cylinders) and the bale is ejected. Subsequent closing of the tailgate 18 returns the apron inner course 42a to the location shown in Figure 1, and the round baler 10 is ready to form another bale.

It will be understood that during formation of a bale, sledge assembly 28 moves from its bale starting position to its full bale position. This movement of the sledge assembly 28 causes the idler roller 40 to move in an arcuate path while maintaining the apron 42 in close proximity to the roller 34, thereby allowing the roller 34 to strip crop material from the apron 42 but preventing the loss of crop material between the roller 34 and the apron 42 during formation of a bale. The sledge assembly 28 is pushed outwardly toward its full bale position during bale formation and is pulled inwardly toward its bale starting position during bale ejection without utilizing any additional mechanisms.

In an alternative embodiment of the round baler 10 which is not shown, apron 42 consists of a pair of chains connected together at spaced intervals by transverse slats, and the idler roller 40 is replaced by a pair of idler sprockets engaged with the chains. Also in this alternative embodiment, the guide rolls 44, 46, 48, 50, 52, 55, 60, 62 would be replaced with guide sprockets for engaging the apron chains, and the drive roll 54 would be replaced by drive sprockets.

The bale wrapping apparatus 64 shown in Figure 1 includes a dispensing mechanism 66 pivotally mounted on the sledge assembly 28 and a cutting mechanism 68 pivotally mounted on the main frame 12. As best seen in Figures 3 and 4, the dispensing mechanism 66 comprises a pair of levers 70 spaced apart but connected by a frame member 71. The levers 70 are rotatably supported on a cross tube 72 that extends between the arms 36 of the sledge assembly 28. Each lever 70 is attached to the cross tube 72 by a clevis 74, and bolts 76 fasten each clevis 74 to brackets 78 fixed to the levers 70. A stop 73 is carried on one of the levers 70 for engagement with one of the arms 36 of the sledge assembly 28 to limit pivoting movement of the dispensing mechanism 66 in a counterclockwise direction as viewed in Figure 2.

The dispensing mechanism 66 also comprises clamping members 80, 82 extending transversely of the baler 10 between the levers 70 and arranged to dispense sheet material S such as net or plastic

film from a supply roll R disposed in a container 83 carried on the baler main frame 12. Container 83 has a lid 85 which may be opened to permit removal of the supply roll R. The clamping members 80 and 82 are mounted respectively on bars 84 and 86 which extend between the levers 70. Springs 88 and links 90 are arranged to urge the clamping member 82 against the clamping member 80. Each spring 88 is connected at one end to one of the links 90 and at the other end to an eye bolt 92 that is fastened to a flange member 94 on one of the brackets 78. The links 90 are engaged with the clamping member 82 in a manner which, due to springs 88, urges the clamping member 82 in a clockwise direction in Figure 3 about the rod 86. As the sheet material S is dispensed from the supply roll R by the dispensing mechanism 66, it passes over a roller shaft 95 which is mounted in and extends transversely of the baler main frame 12.

Referring to Figure 2, the bale wrapping apparatus 64 also includes a power source such as an electric motor 96 mounted on the main frame 12 with an output shaft 97 thereof connected to a large sprocket 98 by a drive chain 100. Another drive chain 102 connects a small sprocket 104 (which is attached to large sprocket 98) with a sprocket 106. A further drive chain 108 connects a small sprocket 110 (which is attached to sprocket 106) with a small sprocket 112. A first link 114 is pinned at one end to drive chain 108 and pivoted at the other end to a second link 116. A third link 118 is pivotally connected between the second link 116 and one of the levers 70 of the dispensing mechanism 66.

The cutting mechanism 68 includes a pair of spaced apart arms 120 rotatably supported on a shaft 122. A knife 124 is carried by and extends transversely between the arms 120 for engagement with the sheet material S dispensed by the dispensing mechanism 66. The arms 120 are rotated on the shaft 122 by means (not shown) such as a cam actuated linkage connected between one of the arms 120 and the link 114. The clamping members 80 and 82 of the dispensing mechanism 66 include upper and lower plates 126 and 128, respectively, between which the sheet material S is fed. Upper plate 126 has a leading edge 126a with a plurality of generally semicircular notches 127 formed therein as shown in Figure 5 while lower plate 128 has a leading edge 128a with a plurality of serrated teeth 129 formed therein as shown in Figure 6.

When a bale B has been formed in the round baler 10 and it is desired to wrap the bale B with the sheet material S, the electric motor 96 is activated while the apron 42 continues to rotate the bale B in a clockwise direction as viewed in Figure 2. The output shaft 97 of the electric motor 96

drives the sprocket 106 via chains 100, 102. Sprocket 110 drives sprocket 112 via chain 108 which causes movement of the links 114, 116, 118 from the solid line positions of Figure 2 to the broken line positions of Figure 2. This rotates the dispensing mechanism 66 from a retracted position shown in solid lines in Figure 2 to a dispensing position shown in broken lines in Figure 2. In the retracted position of the dispensing mechanism 66, a tail T of the sheet material S is gripped by the clamping members 80, 82 thereby preventing the sheet material S from being fed into the bale forming chamber of the baler 10. However, in the dispensing position of the dispensing mechanism 66, the tail T of the sheet material S is inserted into the bale forming chamber and sheet material S is dispensed from the supply roll R into the bale forming chamber.

As the dispensing mechanism 66 moves toward its dispensing position, the cutting mechanism 68 is rotated clockwise to the position shown in Figure 2 and the clamping members 80, 82 move into a gap 35 between the roller 34 and the apron 42. The tail T of the sheet material S gripped between the clamping members 80, 82 is inserted through the gap 35 into the bale forming chamber where it is caught between the roller 34 and the bale B which are rotating in opposite directions. The sheet material S is then dispensed from the supply roll R, over the roller shaft 95, between the clamping members 80 and 82, and then through the gap 35 into the bale forming chamber where it is wrapped circumferentially around the bale B while the bale B continues to be rotated by the apron 42.

After the bale B has been wrapped with one or more layers of the sheet material S, the electric motor 96 is reversed thereby moving the dispensing mechanism 66 from the dispensing position shown in broken lines in Figure 2 to the retracted position shown in solid lines in Figure 2. The links 114, 116, 118 move back to their solid line positions of Figure 2. When the dispensing mechanism 66 has returned to its retracted position, the cutting mechanism 68 is rotated counterclockwise as viewed in Figure 2 so that the knife 124 is brought downwardly into contact with the sheet material S extending from the clamping members 80, 82 of the dispensing mechanism 66. The knife 124 cuts the sheet material S but leaves another tail T which is gripped by the clamping members 80, 82 for future insertion into the bale forming chamber whenever the next bale is ready to be wrapped with the sheet material S.

The details of the upper and lower plates 126 and 128, respectively, are shown in Figures 5 and 6. The semicircular notches 127 formed in the leading edge 126a of upper plate 126 prevent the

tail T of the sheet material S from being carried out of the gap 35 by the apron 42 when the dispensing mechanism 66 is in the dispensing position. In other words, the notches 127 insure proper dispensing of the sheet material S from the supply roll R into the bale forming chamber of the baler 10. The serrated teeth 129 are provided in the leading edge 128a of lower plate 128 for the purpose of allowing the sheet material S to spread to its nominal width as it is being dispensed from the supply roll R. As seen in Figure 6, the serrated teeth 129 are slanted outwardly in opposite directions (i.e. left and right) beginning near the center of the lower plate 128. This orientation of the teeth 129 allows the sheet material S to spread transversely across substantially the full width of the bale forming chamber of the baler 10 and keeps the sheet material S spread while it is being wrapped circumferentially around a cylindrical bale disposed in the bale forming chamber. Teeth 129 also prevent the sheet material S from retracting after it has been cut by the knife 124 thereby assuring the formation of the tail T.

Claims

1. An agricultural baler (10) comprising :
 - a bale forming chamber in which cylindrical bales (B) of crop material are formed; and
 - a bale wrapping apparatus (64) including means (66) for dispensing sheet material (S) from a supply source (R) into the bale forming chamber of the baler (10) in a manner such that it is wrapped circumferentially around a cylindrical bale (B) of crop material disposed in the bale forming chamber; and
 - characterized in that said dispensing means (66)
 - are movable between a retracted position wherein sheet material (S) is prevented from being dispensed into the bale forming chamber and a dispensing position wherein sheet material (S) is dispensed from the supply source (R) into the bale forming chamber; and
 - include means (80, 82, 126, 128) for gripping a tail (T) of the sheet material (S) when the dispensing means (66) is in said retracted position and for inserting said tail (T) into the bale forming chamber when the dispensing means (66) is in said dispensing position.
2. An agricultural baler (10) according to claim 1 characterized in that the bale wrapping apparatus (64) further also comprises means (68) for cutting the sheet material (S) after it has been

wrapped around a cylindrical bale (B).

3. An agricultural baler (10) according to claim 2 characterized in that said cutting means (68) is operable to cut the sheet material (S) when the dispensing means (66) are in said retracted position thereby leaving another tail (T) on the sheet material (S) which is gripped by the dispensing means (66) for future insertion into the bale forming chamber.
4. An agricultural baler (10) according to any of the preceding claims characterized in that the gripping means (80, 82, 126, 128) comprise a pair of juxtaposed clamping members (80, 126 resp. 82, 128) between which the sheet material (S) is dispensed; said clamping members (80, 126 resp. 82, 128) including an upper plate (126) and a lower plate (128) arranged to grip the tail (T) of the sheet material (S) therebetween.
5. An agricultural baler (10) according to claim 4 characterized in that the lower plate (128) is urged towards the upper plate (126) by resilient means (88, 90).
6. An agricultural baler (10) according to claims 4 and 5 characterized in that the clamping members (80, 126 resp. 82, 128) are supported by and extend between a pair of levers (70) which are spaced apart and rotatably mounted.
7. An agricultural baler (10) according to claim 6 characterized in that moving means (96) are provided for moving the dispensing means (66) between said retracted and dispensing positions; the moving means (96) comprising power means (96) coupled to the pair of levers (70) by link means (114, 116, 118).
8. An agricultural baler (10) according to claim 7 characterized in that :
 - said link means (114, 116, 118) comprise first, second and third links (114, 116, 118) connected between said power means (96) and at least one of the pair of levers (70); and
 - said power means (96) comprises an electric motor (96).
9. An agricultural baler (10) according to any of the claims 4 to 8 characterized in that the upper plate (126) has a leading edge (126a) provided with a plurality of generally semicircular notches (127) which prevent the tail (T) of the sheet material (S) from being carried out of the bale forming chamber when the dispensing means (66) is in the dispensing position.

10. An agricultural baler (10) according to any of the claims 4 to 9 characterized in that the lower plate (128) has a leading edge (128a) provided with a plurality of serrated teeth (129)
 - which allow the sheet material (S) to spread to its nominal width;
 - which keep the sheet material (S) spread while it is being dispensed from said supply source (R) into the bale forming chamber of the baler; and
 - which prevent the sheet material (S) from retracting after it has been cut by the cutting means (68) thereby assuring formation of the tail (T) of sheet material (S).
11. An agricultural baler (10) according to claim 10 characterized in that the serrated teeth (129) are slanted outwardly in substantially opposite directions beginning near the center of the lower plate (128).
12. An agricultural baler (10) according to any of the preceding claims wherein the baler (10) further comprises :
 - a main frame (12);
 - a tailgate (18) pivotally connected to said main frame (12);
 - a sledge assembly (28) mounted on said main frame (12) for movement between a bale starting position and a full bale position; said sledge assembly (28) including a plurality of rollers (30, 32, 34) extending transversely of the main frame (12); and
 - an apron (42) movably supported on the main frame (12) and the tailgate (18); said apron (42) cooperating with the rollers (30, 32, 34) of said sledge assembly (28) to define a bale forming chamber; and
 characterized in that the dispensing means (66) are pivotally mounted on said sledge assembly (28) for movement between said retracted position and said dispensing position.
13. An agricultural baler (10) according to claim 12 characterized in that the dispensing means (66) are operable in said dispensing position to insert the tail (T) of sheet material (S) through a gap (35) between the apron (42) and one of the rollers (34) of the sledge assembly (28) in a manner such that the tail (T) is caught between said one roller (34) and said cylindrical bale (B); this bale (B) being rotated in the bale forming chamber by the apron (42).
14. An agricultural baler (10) according to claim 13 characterized in that :
 - the sledge assembly (28) further also comprises idler means (40) engaging the

- apron (42) for maintaining said apron (42) in close proximity to said one roller (34) during movement of the sledge assembly (28) between said bale starting and full bale positions; and
- the gap (35) is located between the idler means (40) and said one roller (34).
15. An agricultural baler (10) according to any of the claims 12 to 14 characterized in that the apron (42) has an inner course (42a) which is expandable in length around a portion of the circumference of a cylindrical bale (B) during formation thereof; said inner course (42a) co-operating with the rollers (30, 33, 34) of the sledge assembly (28) to define the bale forming chamber.
16. An agricultural baler (10) according to claim 15 characterized in that :
- the apron (42) comprises a plurality of flat belts arranged side-by-side; the inner course (42a) of the apron (42) forming a rear wall of the bale forming chamber; and
 - the rollers (30, 32, 34) of the sledge assembly (28) are disposed in an arcuate arrangement; said rollers (30, 32, 34) forming the front wall of the bale forming chamber.
17. A method of wrapping cylindrical bales (B) of crop material with sheet material (S) in a bale forming chamber of an agricultural baler, said method comprising the step of gripping a tail (T) of the sheet material (S) in dispensing means (66) during formation of a cylindrical bale (B) of crop material; and
- being characterized in that it further also comprises the steps of :
- moving the dispensing means (66) from a retracted position to a dispensing position after completion of a cylindrical bale (B) in the bale forming chamber;
 - inserting said tail (T) of the sheet material (S) into the bale forming chamber when the dispensing means (66) is in said dispensing position; and
 - moving the dispensing means (66) from the dispensing position to the retracted position after at least one layer of sheet material (S) has been wrapped circumferentially around said cylindrical bale (B).
18. A method according to claim 17 characterized in that it further also comprises the step of cutting the sheet material (S) when the dispensing means (66) is in said retracted position.
19. A method according to claim 17 or 18 characterized in that the gripping step includes clamping the tail (T) of the sheet material (S) between a pair of clamping member (80, 126 resp. 82, 128) to prevent the sheet material (S) from being dispensed when the dispensing means (66) is in said retracted position.
20. A method according to any of the claims 17 to 19 characterized in that the moving step comprises pivoting the dispensing means (66) on the agricultural baler (10).
21. A method according to any of the claims 17 to 20 characterized in that the inserting step is performed without utilizing feed rollers.
22. A method according to claim 18 or any of the claims 19 to 21 when appended to claim 18 characterized in that the cutting step includes rotating a knife (124) into engagement with the sheet material (S).
23. A method according to any of the claims 17 to 22 characterized in that the moving steps are performed by using power means (96) connected to the dispensing means (66).
24. A method according to any of the claims 17 to 23 characterized in that the wrapping step includes rotating the cylindrical bale (B) in the bale forming chamber as the sheet material (S) is wrapped circumferentially around the cylindrical bale (B).

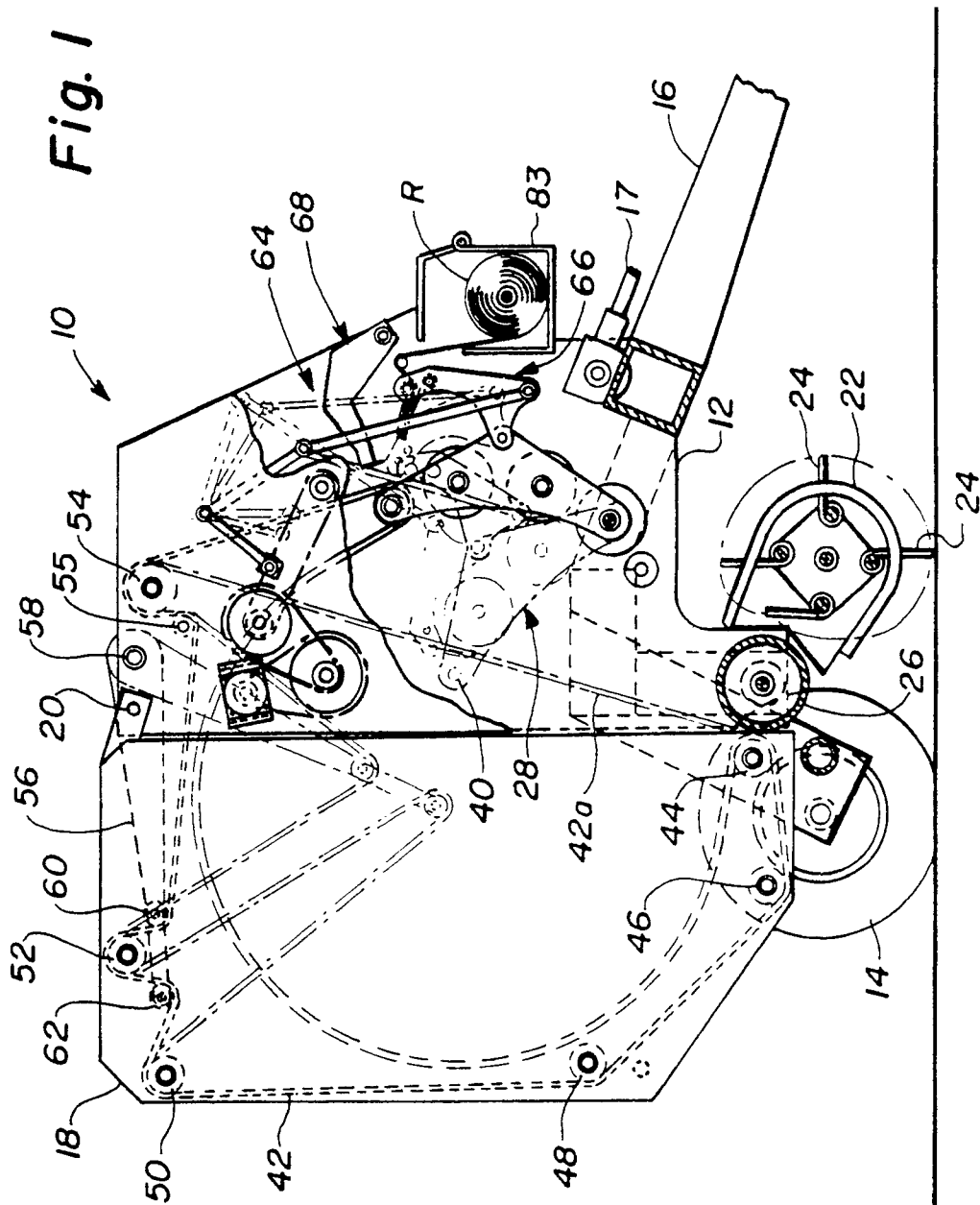
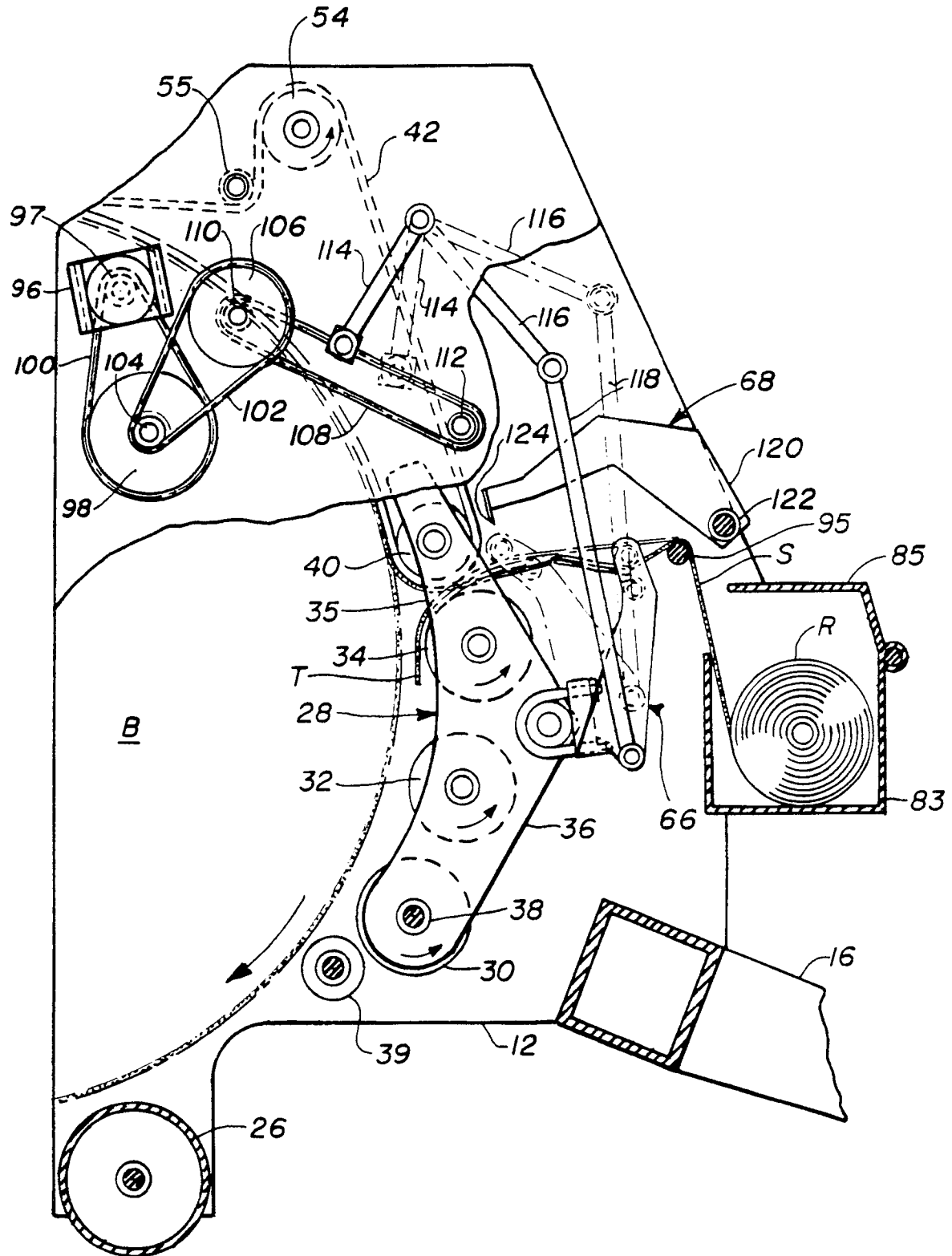


Fig. 1

Fig. 2



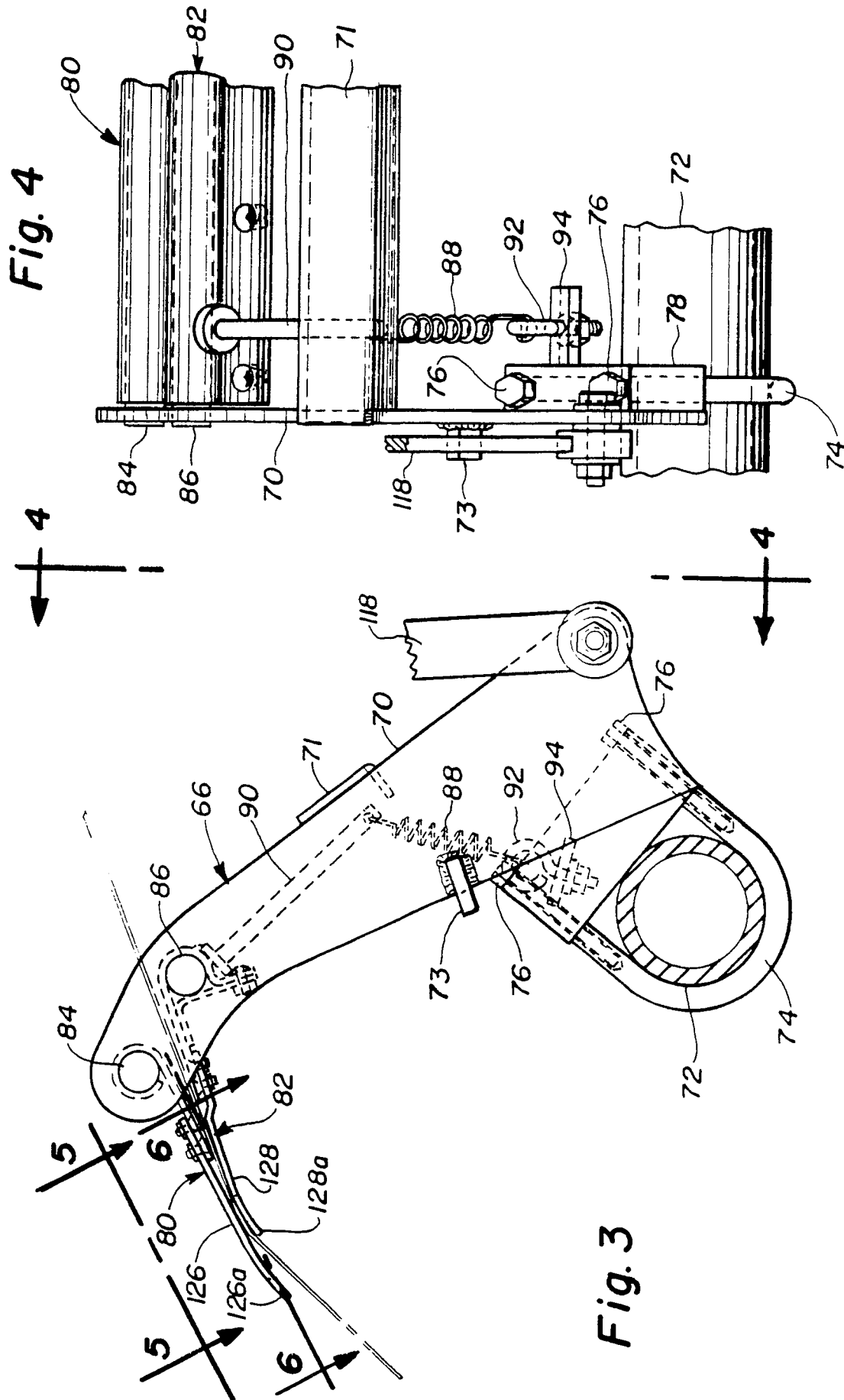


Fig. 5

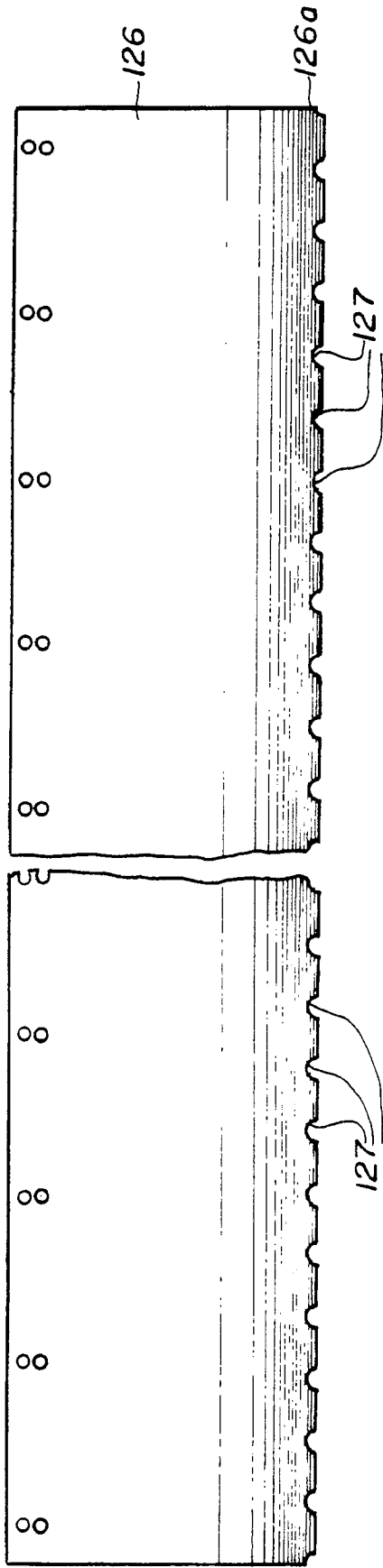
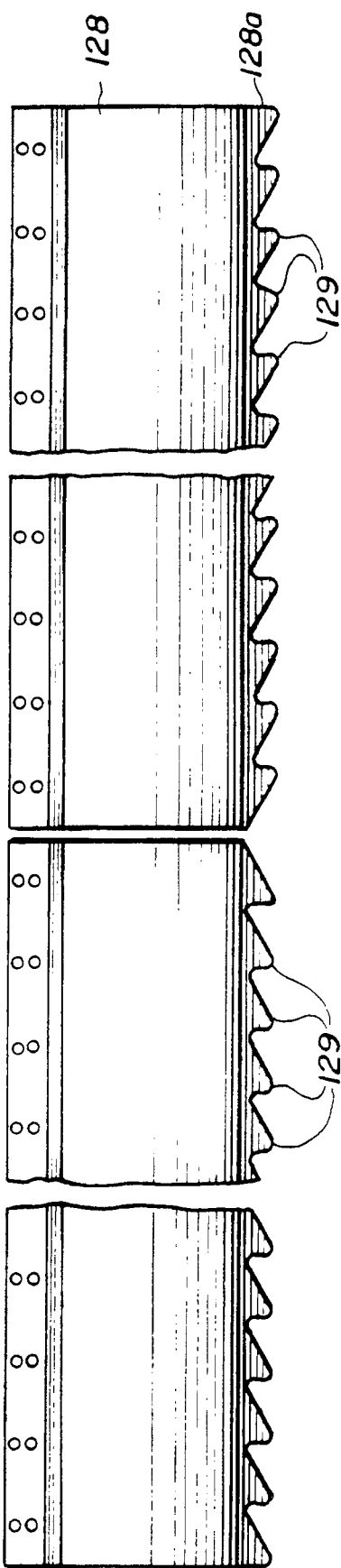


Fig. 6





European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 20 3166

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 604 855 (B. KRONE) * Column 6, line 49 - column 7, line 64; figures 1-5 * - - -	1,2,3,17, 18,19	A 01 F 15:07 A 01 F 15:08
D,X	US-A-4 790 125 (J.H. MERRITT) * Column 3, line 64 - column 6, line 28; figures 1-9 * - - -	1,2,3,17, 18,19	
D,X	US-A-4 729 213 (J.L.M. RAES) * Column 3, line 13 - column 5, line 11; figures 1-4 * - - -	1,2,3,17, 18,19	
D,A	US-A-4 870 812 (R.E. JENNINGS) * Column 2, line 21 - column 3, line 49; figures 1-3 * - - -	1,17	
A	GB-A-2 137 927 (GLASS OHG) * Page 1, lines 91-124; figure 1 * - - - - -	1,2,3,17, 18,19	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 01 F B 65 B B 65 H
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		08 March 91	ELSWORTH D.S.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document			